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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new non-provisional applications under 37CFR§1.53(b))

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No.

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First Inventor or Application
Identifier

Borden et al.

Title

METHOD OF SELECTING TARGETS AND GENERATING
FEEDBACK IN OBJECT TRACKING SYSTEMS

Express Mail Label No.

EL472157542US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO:

Assistant Commissioner for Patents
Box Patent Application
Washington, D.C. 20231

- 1.
- ☒
- Fee Transmittal Form (e.g. PTO/SB/17)

(Submit an original and a duplicate for fee processing)

- 5.
- ☐
- Microfiche Computer Program (Appendix)

- 2.
- ☒
- Specification

Total Pages 16

(preferred arrangement set forth below)

- Descriptive Title of the Invention
- Cross References to Related Applications
- Statement Regarding Federally Sponsored Research
- Reference to Microfiche Appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings (if filed)
- Detailed Description
- Claim(s)
- Abstract of the Disclosure

6. Nucleotide and/or Amino Acid Sequence Submission
-
- (if applicable, not necessary)

- a. ☐ Computer readable copy
- b. ☐ Paper copy (identical to computer copy)
- c. ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

- 7.
- ☒
- Assignment Papers (cover sheet & document(s))

- 8.
- ☒
- 37 CFR §3.73(b) Statement
- ☒
- Power of Attorney
-
- when there is an assignee

- 9.
- ☐
- English translation document (if applicable)

- 10.
- ☐
- Information Disclosure Statement (IDS) /PTO
-
- Copies of IDS Citations
-
- 1449

- 11.
- ☐
- Preliminary Amendment

- 12.
- ☒
- Return Receipt Postcard (MPEP 503)
-
- (should be specifically itemized)

- 13.
- ☐
- *Small Entity Statements (PTO/sb/09-12)
- ☐
- Statement filed in prior application.
-
- Status still proper and desired.

- 14.
- ☐
- Certified Copy of Priority Document(s)
-
- (if foreign priority is claimed)

- 15.
- ☒
- Other: 1.) Check in the amount of \$1384
-
- 2.) Associate Power of Attorney

- 3.
- ☒
- Drawing(s) (35 USC 113)

(Total Pages 3)

4. Oath or Declaration

(Total Pages 3)

- a.
- ☒
- Newly executed (original or copy)

- b.
- ☐
- Copy from a prior application (37 CFR §1.63(d))
-
- (for continuation/divisional with Box 16 completed)

- 1.
- ☐
- Deletion of Inventor(s)

Signed statement attached deleting inventor(s)
named in the prior application.
see 37 CFR §§1.53(d)(2) and 1.33(b)*Note for Items 1 & 13: In order to be entitled to pay small
entity fees, a small entity statement is required (37 CFR §1.27),
except if one filed in a prior application is relied upon (37 CFR
§1.28)

16. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: ____/____

Prior application information: Examiner _____ Group No./Art Unit _____

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under
Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference
The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

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A METHOD OF SELECTING TARGETS AND GENERATING
FEEDBACK IN OBJECT TRACKING SYSTEMS

BACKGROUND OF THE INVENTION

5 The present invention relates to an improved video capture and display system.

 Object tracking systems are used for auto focusing, auto zoom, and other functions of video cameras. Likewise, object tracking systems are used for
10 auto zoom, brightness adjustment, contrast adjustment, and highlighting functions of video display systems. Imaging devices in video cameras capture images by converting light into electrical signals through a photoelectric process. On the other hand, video display
15 devices utilize electrical signals to control a light source producing an image. Object tracking systems use a number of known methods to process the electrical signals corresponding to an image and to extract a group of signals representing a designated target of the object
20 tracking system. The group of signals representing the target object is relocated and "followed" in the succession of images or frames making up a video sequence.

 To initiate the tracking process, a target must
25 be initially identified for the object tracking system. Object tracking systems may automatically identify a target object based on an assumed usage model for the video capture or display device. For example, the object of interest will most likely to be located near the
30 center of the image and may be the larger object in the vicinity. However, automatic target designation is complex and is problematic if the object of interest is not centrally located in the image, is one of a plurality of similar objects in the vicinity, or if there is little
35 contrast between the object of interest and the surroundings.

User designation of the target object avoids some of the limitations and complexities of automatic target designation. Nishimura et al., U.S. Patent No. 5,631,697, for VIDEO CAMERA CAPABLE OF AUTOMATIC TARGET TRACKING, describe a system in which the user designates the target by aligning an electronic marker generated in the viewfinder with the image of the intended target object and then depressing a switch to activate the target tracking processor. While less complex and more flexible than fully automatic target designation, the system provides only for user designation of the target object's location.

To separate the group of signals representing the target object from the larger group of signals representing the image, target tracking systems utilize information about the size of the target object, as well as its location. Automatic or manual methods may be used to designate the target's size once its location has been manually designated. Automatic determination of the target object's size is complex and often unreliable, especially in crowded or low contrast images. To reduce the complexity of the tracking system and increase the reliability of target identification, the system may permit the user to designate the target's size. For example, the target object's size may be designated by drawing an "electronic" box bounding the target object. However, drawing a box around a moving target while operating a video camera is not easily accomplished and even locating a target in a viewfinder when there is little contrast between the target object and the surroundings or when the target is located at a distance may be difficult for a user.

What is desired, therefore, is a method of designating a target object for an object tracking system that allows the user to easily locate the target object and reliably designate its location and size for the tracking system. Further, a method of notifying the user

of the continuing performance of the tracking system is desired.

SUMMARY OF THE INVENTION

5 The present invention overcomes the
aforementioned drawbacks of the prior art by providing an
object tracking system that includes initiating the
object tracking system, magnifying the image, selecting
an object of interest in an image, and designating the
10 object as the target all while the object tracking system
is activated. In this manner it is easier for the user
of the object tracking system to select the target,
especially if the target tends to be moving fast.

 In another aspect of the object tracking system
15 an image is magnified and an object is designated as the
target for tracking by the tracking system. In response
to designating the object the scale of the image is
automatically changed. In one embodiment, this permits
the user to zoom in on the image, select the target more
20 easily, and then automatically zoom out, which permits
easier selection of the target.

 In yet another aspect of the present invention,
the object tracking system monitors a level of confidence
that the tracking system is properly tracking the target.
25 In response to a change in the level of confidence the
magnification of the image visible to the operator is
altered.

 The foregoing and other objectives, features
and advantages of the invention will be more readily
30 understood upon consideration of the following detailed
description of the invention, taken in conjunction with
the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

35 FIG. 1 is a block diagram of a video camera
employing the method of the present invention.

FIG. 2 is a flow chart of object tracking functionality.

FIG. 3 is an exemplary viewfinder image of the video camera of FIG. 1.

5 FIG. 4 is a magnified view of the exemplary viewfinder image of FIG. 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, a video camera according to the present invention includes video capture and display systems. The video camera includes a lens unit 10, an imaging device 12 which may be a charge coupled device (CCD) or metal oxide semiconductor (MOS) array, an A/D (analog to digital) converter 14, a signal processor 16, a driver 18 to drive the imaging device 12, and a D/A (digital to analog) converter 20. The imaging device 12 includes a plurality of photoelectric elements arranged in a two-dimensional array on one surface. The light of an optical image is focused on the photoelectric elements of the imaging device 12 by the lens unit 10. Each photoelectric element converts the light from the image that is striking the element into an analog electrical signal. Periodically, the driver 18 connects elements of the imaging device 12 to the A/D converter 14 causing the electrical signals produced by the elements of the imaging device 12 to be converted to digital signals which are read by the signal processor 16. The signal processor 16 converts the digital signals to video signals representing the luminance and chrominance of the light striking each element of the imaging device 12. The composite video signals are output to the D/A converter 20 for conversion to the analog signals of the camera's video output 22. The video output 22 may be transmitted or recorded and is displayed on a viewfinder 24 so that the user can visualize the images being transmitted or recorded by the camera.

The video camera also includes a target tracking processor 26 that processes the output of the signal processor 16 to extract signals representing the target object from the signals representing the image in the succession of images or frames making up the video sequence. The video camera includes a zoom processor 28, a cursor generator 30, and a controller 32. The camera may also include a zooming motor 34 and an auto focus motor 36 driving the zooming and focusing mechanisms of the lens unit 10. As the lens 10 zooms in or out, the optical image is magnified on the imaging device 12 producing a magnified image at the video output 22 and in the display of the viewfinder 24. It is to be understood that magnification may include the result of zooming in or zooming out. On the other hand, zooming may be accomplished by processing signals from a region of the imaging device 12. The zoom processor 28 may extract signals from a portion of the imaging device 12 and calculate zoom information from those signals to electronically magnify a portion of the image that is displayed in the viewfinder 24.

Traditional video tracking systems include the user zooming in or zooming out until the object is clearly visible within the display and then the user initiates the tracking functionality. Thereafter, the user then selects the target to be tracked by the video tracking system. The present inventors came to the realization that while a workable technique for tracking targets, it is clumsy because by the time the user initiates the tracking functionality and then selects the target, the target may have already moved out of the field of view. This is especially true when the object takes up a significant portion of the display, such as when under extreme zoom. To overcome these limitations the present inventors have developed a new interface for a tracking system. Referring to FIGS. 2 and 3, first the tracking functionality is initialized by any appropriate

technique. Next, the target is located, sized, and positioned on an electronic viewfinder 24 for accurately selecting and subsequent tracking. A cursor 42 is generated by the cursor generator 30 and is superimposed on the image in the electronic viewfinder 24. The cursor 40 may be in a fixed location in the viewfinder 24 (e.g., centered) and positioned over the image of the target object by movement of the camera which effectively moves the viewfinder image behind the cursor 42. On the other hand, the cursor may be movable and electronically positioned in the viewfinder image by operation of a joystick, touch pad or other pointing device 38 (refer to FIG. 1). A target designator switch 39 facilitates signaling the controller 32 that a target is being designated for tracking. The target designator switch 39 and the pointing device 38 may be combined into a single control element permitting the user to conveniently position a movable cursor 42 and designate the target. A movable cursor 42 permits the user to designate target objects that are not centered in the image. To initiate tracking, the user aligns the cursor 42 to superimpose the cursor 42 on the target object and actuates the target designator switch 39. Preferably, the target designator switch 39 and the pointing device 38 are combined by touch sensitive viewfinder 24. In this manner, the user may simply target and select the target to be tracked by a single action. The physical activity used on the video camera for targeting and selecting (e.g., buttons and controls) are preferably different than that used for zooming, which permits the targeting and selecting functions to be placed into a "ready" state. In the case of the touch screen viewfinder 24, while touching the viewfinder 24 may be used for many different functions, after initialing the tracking functionality the touch screen viewfinder's next function is automatically set to targeting and selecting of the target. Accordingly, after zooming a single action of

touching the viewfinder 24 screen will perform targeting and selecting in a fast and efficient manner before the target, especially if moving fast, is no longer displayed on the viewfinder 24.

5 In one embodiment of the present invention, actuation of the target designator switch 39 causes the controller 36 to signal the zoom processor 28 to begin zooming. The zoom processor 28 performs the zoom calculation or actuates the zoom motor 34 causing the
10 zoom lens unit 34 to zoom in, magnifying the image in the viewfinder 24. Referring to FIG. 4, the image in the viewfinder 24 is magnified until the target object 44 is easy to view and designate. The user then designates the target object by actuating the target designator switch
15 39 for a second time. This may likewise be performed by a touch sensitive viewfinder 24 where after initiating tracking functionality the user touches the screen to start zooming and touches the screen a second time to designate the target. The first zooming may be
20 automatic, if desired. Designation of the target causes the target tracking processor 26 to extract the signals representing a target designated at the location of the cursor (or touch on the screen) from the signals of the image in a scan of the imaging device 12. A target may
25 be identified in any manner. The target tracking processor 26 then "follows" this group signals representing the target object in subsequent scans of the imaging device 12 to track the target as the video sequence progresses.

30 In another embodiment of the present invention, actuation of the target designator switch 39 causes the controller 36 to signal the target tracking processor to initiate tracking and the zoom processor 28 to begin zooming in. When the image of the tentative target is
35 easy to view in the viewfinder 24 the user designates the target object a second time by actuating the target designator switch 39. The target object is tentatively

identified for the target tracking processor 26 by the first actuation of the target designator switch 39 but the information about the size and location of the target is refined and verified in the magnified image where the target object is more visible.

The zoom processor 28 may then zoom out electronically or by actuating the zoom motor 34 to return the zoom to the original setting or some intermediate setting established by the user. The present inventors realized that zooming in on the target object would make it easier to locate the target object if it is at a distance from the camera or in low contrast or crowded surroundings. Further, automatically zooming the image provides a convenient method of establishing the target. This may likewise be performed with a touch sensitive display.

The algorithm applied by the target tracking processor 26 may include a measurement of the level of confidence that the target is being correctly tracked. If the level of confidence should decrease, the tracking processor 26 may cause the zoom processor 28 to begin zooming in. The changing magnification of the image in the viewfinder 24 notifies the user that the confidence level of the algorithm is low. Increasing the magnification of the image may cause the algorithm's confidence level to increase. On the other hand, if the algorithm cannot automatically reacquire the target object, increasing the magnification of the image will facilitate relocation of the target object by the user who may re-designate the target for the tracking system by actuating the target designator switch 39.

While tracking a target periodically the target may be obscured or otherwise not visible on the viewfinder 24 for a period of time. This may occur, for example, when another object comes in between the target and the camera for a period of time. When the target is not detected by the target tracking processor, the system

may automatically switch into an alternative global tracking motion mode to predict where the object should be. In this manner, when the target is no longer obscured or otherwise not visible on the viewfinder 24 the target tracking processor will have an increased change of identifying the target to continue tracking. In this manner, the system is less likely to loose track of the target.

When the confidence of the system is sufficiently low (or losing the target totally) the present inventors came to the realization that most likely the target is no longer visible within the viewfinder 24. Accordingly, in such an event the system may automatically zoom out (or in) to present the viewer with an image having a greater (or lesser) field of view. In most instances, the target will be visible to the user within the new field of view image. The user then may select the target within this field of view in the manner described above, as desired. Alternatively, after the zooming in response to the confidence level the system may exit the tracking functionality.

Yet in another aspect of the present invention, the present inventors came to the realization that control over the amount of magnification provided by the system for the selection of the target should operate in an intuitive and efficient manner. The intuitive system developed by the present inventors includes the user selecting a target object for tracking, in any manner, such as those previously described. Preferably, after selecting the target object the tracking system tracks the target object. In the event that the user triggers another target object selection within a predetermined time period, then the system will cease object tracking, if object tracking was already initiated, and change the magnification of the image on the display. The same or a different object may be selected for the another target object selection. For example, the magnification for the

target objection selection may be performed by, for example, clicking a mouse twice (or multiple times) or touching a display twice (or multiple times). After changing the magnification of the image, the system then permits the user to select a target object for tracking. Again, if the user triggers another target object selection within a predetermined time period, then the system will cease object tracking, if object tracking was already initiated, and change the magnification of the image on the display (such as increase magnification). This process is repeated until the user does not trigger another target object selection within a predetermined time period. This permits magnification of the image until the target can be easily selected for tracking. The target selected for tracking is preferably the last selected object. After tracking is initiated, and preferably the predetermined time period has elapsed, the system may return to a previous magnification, if desired.

While the tracking system has been described in relation to a video camera, the teachings are equally applicable to selection and tracking when viewing video, from any source, such as for example, a video cassette recorder, digital tape, analog tape, compact disc, and digital video disc.

All the references cited herein are incorporated by reference.

The terms and expressions that have been employed in the foregoing specification are used as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding equivalents of the features shown and described or portions thereof, it being recognized that the scope of the invention is defined and limited only by the claims that follow.

CLAIMS

1. A method of tracking a target for an object tracking system comprising the steps of:

- 5 (a) initiating said object tracking system;
(b) magnifying said image while said object tracking system is activated;
(c) selecting an object of interest in an image while said object tracking system is
10 activated; and
(d) designating said object as said target of said tracking system while said object tracking system is activated.

15 2. The method of claim 1 wherein said image is magnified by adjustment of an optical lens.

3. The method of claim 1 wherein said image is magnified by adjusting an electrical signal
20 representing, at least, a part of said image.

4. The method of claim 1 wherein said magnification is an automatic result of said initiating
said object tracking system.

25 5. The method of claim 1, further comprising the step of automatically changing the scale of said image following designation of said object as said target.

30 6. The method of claim 1 wherein said object of interest is selected by the steps of:

- (a) moving a cursor to superimpose said cursor on said object of interest in said image;
35 and

- (b) signaling said tracking system that said cursor is superimposed on said object of interest.

5 7. The method of claim 1 wherein said designating is using a touch sensitive display.

 8. The method of claim 1 wherein said selecting said object of interest and said designating
10 said object uses a different control mechanism than said magnifying said image.

 9. The method of claim 1 wherein said selecting and said designating are performed
15 simultaneously by touching a touch sensitive display.

 10. The method of claim 9 wherein in response to initiating said object tracking system, said touch sensitive display is set to simultaneously said select
20 and said designate upon the next touch of said touch sensitive display.

 11. The method of claim 6 wherein said image is magnified by adjustment of an optical lens.
25

 12. The method of claim 6 wherein said image is magnified by adjusting an electrical signal representing, at least, a part of said image.

30 13. The method of claim 6 wherein said magnification is an automatic result of said initiating said object tracking system.

 14. The method of claim 6 further comprising
35 the step of automatically changing the scale of said image following designation of said object as said target.

15. The method of claim 1 wherein said object of interest is selected by the steps of:

- (a) moving said image to superimpose an image of a cursor on said object of interest;
and
- (b) signaling said tracking system that said cursor is superimposed on said object of interest.

16. The method of claim 15 wherein in response to initiating said object tracking system, said touch sensitive display is set to simultaneously said select and said designate upon the next touch of said touch sensitive display.

17. The method of claim 15 wherein said image is magnified by adjustment of an optical lens.

18. The method of claim 15 wherein said image is magnified by adjusting an electrical signal representing, at least, a part of said image.

19. The method of claim 15 wherein said magnification is an automatic result of said initiating said object tracking system.

20. The method of claim 15 further comprising the step of automatically changing the scale of said image following designation of said object as said target.

21. A method of selecting a target for an object tracking system comprising the steps of:

- (a) magnifying an image;
- (b) designating an object in said image as a target for tracking by said tracking system; and

- (c) in response to said designating of said object as said target, automatically changing the scale of said image.

5 22. The method of claim 21 wherein said image is magnified by adjustment of an optical lens.

 23. The method of claim 21 wherein said image is magnified by adjusting electrical signals
10 representing, at least, a part of said image.

 24. The method of claim 21 wherein said magnification is an automatic result of initiating said object tracking system.
15

 25. The method of claim 21 wherein said first and second designating of said object as said target comprises the steps of:

- (a) moving a cursor to superimpose said cursor on said object in said image; and
20 (b) signaling said tracking system that said cursor is superimposed on said object.

 26. The method of claim 21 wherein said first and second designating of said object as said target comprises the steps of:

- (a) moving said image to superimpose a cursor on said object; and
 (b) signaling said tracking system that said
30 cursor is superimposed on said object.

 27. method of advising an operator of the performance of an object tracking system comprising the steps of:

- 35 (a) monitoring a level of confidence that said tracking system is tracking a target; and

- (b) altering magnification of an image visible to said operator in response to a change in said level of confidence.

5 28. The method of claim 27 wherein said magnification is changed as said level of confidence decreases.

10 29. The method of claim 27 wherein said magnification is decreased if said object tracking system loses track of said target.

15 30. A method of selecting a target for an object tracking system comprising the steps of:
 (a) a first designating of an object in said image as a target for tracking by said tracking system;
 (b) magnifying said image if a second designating of at least one of said object and another object in said image is performed within a predetermined time period;
20 (c) repeating steps (a) and (b) until said second designating is not said performed, and in response tracking said object.
25

 31. The method of claim 30 wherein said first designating of said object comprises the steps of:
30 (a) moving a cursor to superimpose said cursor on said object in said image; and
 (b) signaling said tracking system that said cursor is superimposed on said object.

35 32. The method of claim 30 wherein further comprising the step of changing the magnification of said image in response to said tracking of said object.

A METHOD OF SELECTING TARGETS AND GENERATING
FEEDBACK IN OBJECT TRACKING SYSTEMS

ABSTRACT OF THE DISCLOSURE

5 A system initiates an object tracking system,
magnifies the image, selects an object of interest in an
image, and designates the object as the target all while
the object tracking system is activated. In this manner
it is easier for the user of the object tracking system
10 to select the target, especially if the target tends to
be moving fast.

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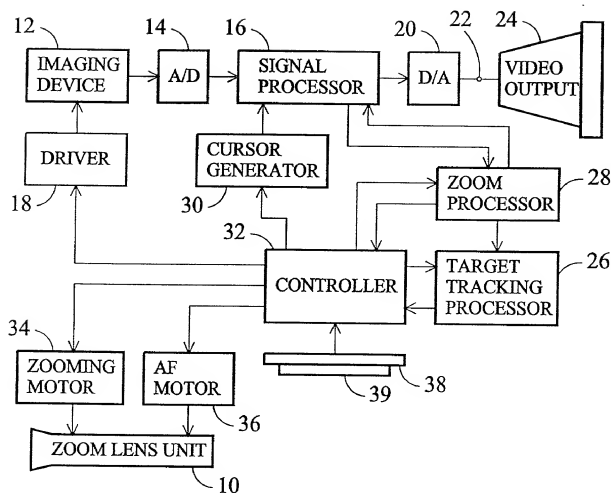


FIG. 1

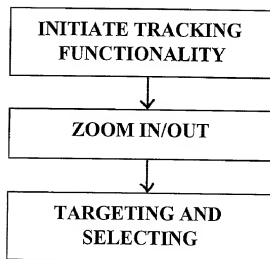


FIG. 2

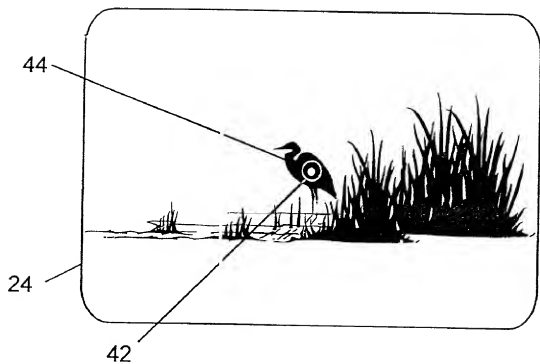


FIG. 3

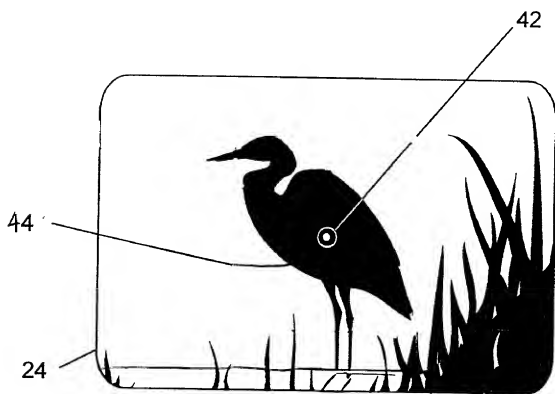


FIG. 4

DECLARATION AND POWER OF ATTORNEY

As the below named inventors, we hereby declare that:

Our residence, post office address and citizenship are as stated below next to our names.

We believe that we are the original inventors of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**METHOD OF SELECTING TARGETS AND GENERATING
FEEDBACK IN OBJECT TRACKING SYSTEMS**

the specification of which

- ☒ is attached hereto.
was filed on _____ as
☐ Application Serial No. _____
and was amended on _____
(if applicable)

We hereby state that we have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above.

We acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56.

We hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

Priority
Claimed

(Number) (Country) (Day/Month/Year Filed) ☐ Yes ☐ No

(Number) (Country) (Day/Month/Year Filed) ☐ Yes ☐ No

We hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below.

(Application Serial No.)

(Filing Date)

We hereby claim the benefit under Title 35, United States Code, § 120, of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, we acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Ser. No.)	(Filing Date)	(Status)
		(patented, pending, abandoned)

We hereby appoint Jacob E. Vilhauer, Jr., Reg. No. 24,885, Charles D. McClung, Reg. No. 26,568, Dennis E. Stenzel, Reg. No. 28,763, Donald B. Haslett, Reg. No. 28,855, William O. Geny, Reg. No. 27,444, J. Peter Staples, Reg. No. 30,690, Kevin L. Russell, Reg. No. 38,292, Bruce W. DeKock, Reg. No. 40,585, Nancy J. Moriarty, Reg. No. 40,733, Timothy E. Siegel, Reg. No. 37,442 and Timothy A. Long, Reg. No. 28,876, all of the firm of Chernoff, Vilhauer, McClung & Stenzel, LLP, 600 Benj. Franklin Plaza, One S.W. Columbia, Portland, Oregon 97258, telephone number 503-227-5631, my attorneys, jointly and individually, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

We hereby declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE UNDER 37 CFR §3.73(b)

Applicant : Borden et al.

Application No: _____ Filed: Concurrently herewith

Title : METHOD OF SELECTING TARGETS AND GENERATING FEEDBACK IN OBJECT TRACKING SYSTEMS

Sharp Laboratories of America, Inc. (Assignee) a Washington corporation (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.) certifies that it is the assignee of the entire right, title and interest in the patent application identified above by virtue of either:

A. ☐ An assignment from the inventor(s) of the patent application identified above. The assignment was recorded in the Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

OR

B. ☐ A chain of title from the inventor(s), of the patent application identified above, to the current assignee as shown below:

1. From: _____ To: _____
The document was recorded in the Patent and Trademark Office at Reel _____, Frame _____, or for which a copy is attached.

2. From: _____ To: _____
The document was recorded in the Patent and Trademark Office at Reel _____, Frame _____, or for which a copy is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet.

☒ Copies of assignments or other documents in the chain of title are attached. (Where one or more of the documents is unrecorded.)

The undersigned has reviewed all the documents in the chain of title of the patent application identified above and, to the best of undersigned's knowledge and belief, title is in the assignee identified above.

The undersigned (whose title is supplied below) is empowered to sign this Certificate on behalf of the assignee.

I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further, that these statements are made with the knowledge that willful false statements, and the like so made, are punishable by fine or imprisonment, or both, under Section 1001, Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date : February 16, 2000

Name : Kevin L. Russell

Title : Attorney for the Assignee (a copy of the Power of Attorney is attached)

Signature: 

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